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NOTES ON SOUTH AMERICAN NON-MARINE MOLLUSCA I-III

I. - VIAGGIO IN VENEZUELA DI NINO SANFILIPPO - MOLLUSCA

Although only four lots of non-marine shells were collected by Nino Sanfilippo, they proved to be of great interest. Identification of these few shells prompted the notes on Venezuelan *Eudolichotus* and review of the mainland *Pomatiasidae* included below.

The species collected by N. Sanfilippo are:

Pachycheilus laevissimus (Sowerby)

Cueva Incanto de San Juan de Lugo, vicinity of Coro, Estado Falcon, Venezuela.

Orthalicus obductus (Shuttleworth)

Pico Santa Ana, Penis. Paraguana, Falcon, Venezuela.

Eudolichotus glabra paraguanensis new subspecies (see p. 418)

Pico Santa Ana, Penis. Paraguana, Falcon, Venezuela.

Tudora (*Tudorata*) *plicatula* (Pfeiffer) (see p. 428)

Guaibacoa, 30 km. southeast of Coro, Falcon, Venezuela.

Detailed information about the localities can be found in Sanfilippo (1958).

II. - NOTES ON VENEZUELAN SNAILS OF THE GENUS *EUDOLICHOTUS*

These notes are supplementary to the studies of H.B. Baker (1926: 31-37). Included are the first definite record for *Eudolichotus dillwyniana* (Pfeiffer) and description of a new subspecies from the Paraguana peninsula.

The following abbreviations are used to indicate the location of the material studied:

ANSP Academy of Natural Sciences, Philadelphia
CNHM Chicago Natural History Museum

MCZ Museum of Comparative Zoology
UMMZ University of Michigan Museum of Zoology
USNM United States National Museum.

Eudolichotus dillwyniana (Pfeiffer)
Pl. 1, figs. 1-3

Bulimus dillwyniana Pfeiffer, Proc. Zool. Soc. London, 1851, p. 258 (Andes of New Granada); Pfeiffer, Syst. Conch. Cab., I, 13, (1), 1854, p. 88, pl. 30, figs, 25, 26.
Auris dillwyniana (Pfeiffer), Pilsbry, Man. Conch., (2), 10, 1896, p. 118, pl. 42, figs. 62, 63.

DISTRIBUTION: Merida (UMMZ 146743 ex Fulton), Sierra Nevada de Merida at 6,000 ft. elev., near Merida (USNM 206482 Solomon Briceno Gabaldon!, CNHM 84756).

REMARKS: A very distinctive species (Pl. 1, figs. 1-3) not hitherto reported from an exact locality.

Eudolichotus bisuturalis gracilis (Pilsbry)

Auris distortus var. *gracilis* Pilsbry, Man. Conch., (2), 10, 1896, p. 111, pl. 40, fig. 31 (Cucuta, Prov. Pamplona, Colombia).

DISTRIBUTION: *Columbia:* Cucuta, Prov. Pamplona (type locality). *Venezuela:* Encontrados, Est. Zulia (CNHM 11728 N. Dearborn! Feb. 22, 1908).

REMARKS: The submarginal impressed line and less strongly contracted apertural base ally this to *E. bisuturalis* rather than *E. distortus*.

Eudolichotus glabra (Gmelin)

Originally known from the satellite islands of Trinidad, Tobago and Grenada, the discovery of a new race in the island-like Paraguana peninsula is a notable range extension. For convenience, references to the other subspecies are included here.

Eudolichotus glabra glabra (Gmelin)

Voluta glabra Gmelin, Syst. Nat., ed. 13, vol. 1, pt. 7, 1793, p. 3436 (Locality unknown).
Auris glabra (Gmelin), Pilsbry, Man. Conch., (2), 10, 1896, pp. 113-114, pl. 41, figs. 33-37 (Trinidad and Tobago).

MATERIAL: Northeast Trinidad (CNHM 17327 H. Field! March 1942); Trinidad (CNHM 31347); north of Speyside, Tobago (MCZ 168797, Mrs. C. E. Alford! 1949, CNHM 84757).

Eudolichotus glabra grenadensis (Guppy)

Plekocheilus glaber var. *grenadensis* Guppy, Ann. Mag. Nat. Hist., (4), 1, 1868, p. 436 (Grenada).
Auris glabra var. *grenadensis* (Guppy), Pilsbry, Man. Conch., (2), 10, 1896, pp. 114-115, pl. 41, figs. 38-39.

MATERIAL: None examined.

Eudolichotus glabra paraguanensis new subspecies (pl. 1, figs. 4-6)

DIAGNOSIS: A subspecies of *E. glabra* characterized by its deeply and regularly curved umbilical lip and markedly curved upper palatal section of the peristome.

HOLOTYPE: Genoa Museum C. E. 37982 from Pico Santa Ana at 550 meters elevation, Peninsula Paraguana, Est. Falcon, Venezuela. Collected by Nino Sanfilippo on July 5, 1956.

DESCRIPTION: Shell perforate, elongate fusiform, solid. Ground color of nuclear whorls and spire saffron, turning whitish with purple streaks and blotches below. Whorls 5 3/4. Nuclear whorls 2-1/4, smooth. Remaining whorls with retractive, low, broad interrupted and undulating ribs, becoming broken on body whorl (Pl. 1, fig. 6). Suture well marked with a submarginal line developing on lower portion of spire. Aperture 20.7 mm. long, oblong-ovate. Peristome white, broadly reflected near base, less so at upper margin. Outer lip only slightly sinuate. Basal lip deeply and regularly curved up to base of whitish columellar fold. Height 45.1, diameter 19.8 mm.

REMARKS: The shells of *Eudolichotus* vary greatly, and some hesitation is felt in describing a subspecies based on only a single specimen. The structure of the basal lip, however, is strikingly different from any of the more than 1,000 specimens of *Eudolichotus* seen in American museums. The mainland complex of *E. distortus* and *E. bisuturalis* differs in having the typically constricted basal aperture. Only the high mountain *E. dillwyniana* (Pl. 1, fig. 1) and the Trinidad-Tobago *E. glabra* have partially rounded basal lips. *E. dillwyniana* is a much smaller, smoother shell with spiral sculpture. The only comparable species is the Trinidad-Tobago *E. glabra*. In general shape, color and sculpture, the new form falls into the range of variation shown by the nominate subspecies. The Paraguana shell differs in the formation of the basal lip (Pl. 1, figs. 4,5).

Ecologically, the Pico Santa Ana is as much of an island as are Trinidad and Tobago, it being a lush tropical forest rising out of near desert conditions. Possibly the new subspecies is a periphereal remnant of a formerly continuous distribution from Paraguana over to Trinidad, the intermediate populations no longer existing because of replacement by the *E. distorta* complex.

III. - POMATIASID SNAILS OF SOUTH AMERICA

Before discussing the species, it is necessary to briefly review the current classification of the American *Pomatiasidae*. Henderson and Bartsch (1920) separated the New World species into the Family *Annulariidae* on the basis of the central and lateral teeth being unicuspid in the New World and multicuspid in the Old World groups. H. B. Baker (1924a) showed that some New World species also had multicuspid central and lateral teeth and refused to accept the separation. Thiele and Wenz follow Baker in refusing to separate the Old World from the New World genera.

Besides the new family, Henderson and Bartsch (1920) recognized four new subfamilies, based on the structures of the operculum (see Torre and Bartsch, 1941: 132 for a synopsis of the differences), and numerous genera and subgenera based on the extent and angulation of the calcareous opercular lamellae, the presence or absence of breathing pores or spiral sculpture, the prolongation of axial ribs into tufted lamellae at the suture, whether the body whorl becomes solute, and the development of spiral umbilical sculpture. All divisions were based on the rigid application of single features with each subdivision subsequently being based on another single character.

The variation shown by *Choanopoma barkeri* (see below) encompasses three « generic » characters, and the bewildering shell variation shown by the Dutch West Indian *Tudora* (see H. B. Baker, 1924b and Hummelinck, 1940) reduce the artificial pigeonholes of Henderson and Bartsch (1920) to complete absurdity. Similarly, the monographs of the Cuban (Torre and Bartsch, 1938, 1941) and Bahaman and Hispaniolan (Bartsch, 1946) pomatiasids are exercises in card filing rather than attempts at biological classification (see review by Baker, 1941).

In summary, the West Indian pomatiasids have been split into highly artificial categories which probably bear only coincidental relationship to phylogeny. It is presently impossible to draw any valid

conclusions as to distribution and phylogeny within the family, and very difficult to decide on any practical generic placement of the mainland forms.

The Dutch West Indian *Tudora* and *Cistulops* have been carefully studied by H. B. Baker (1924b: 35-70) and Hummelinck (1940: 52-74). Reference to these species are not repeated here. Following H. B. Baker (1928: 47-49) I am recognizing two broad generic groupings: *Tudora* (*Tudorata*) for the relatives of *Tudora plicatula* (Pfeiffer) which have broadly expanded simple lips, and *Choanopoma* (*Choanopomops*) for the group of *Choanopoma aripensis* (Guppy) which have multiplex peristomes or in one specialized species, a simple, unreflected lip.

Anatomical review of the species may alter the generic groupings, but only empty shells and operculi were available for study. The sexes are separate in the pomatiasids with the shell of the female being considerably larger than that of the male. Since the available material could not be sexed, it was considered useless to give average measurements of large series of mixed sexes. Measurements have been confined to the holotype of new species and the largest and smallest individuals seen.

ERRONEOUS AND QUESTIONABLE LITERATURE RECORDS

Several « *Cyclostoma* » originally described as coming from South America have subsequently been found to have erroneous locality data. Others have not been rediscovered and probably also will be shown to have erroneous data.

Sowerby (1843) in his monograph of *Cyclostoma* described a number of species from Demerara, British Guiana. The references and current disposition of the names are as follows:

Cyclostoma suturale Sowerby, Thes. Conch., 1, 1843, p. 91, pl. 23, figs. 1, 2 (Demerara). This is the Jamaican cyclophorid *Cyclojamaicia suturalis* (See Bartsch, 1942: 69).

Cyclostoma discoideum Sowerby, Thes. Conch., 1, 1843, p. 111, pl. 25, figs. 87, 88 (Demerara). This is the Javanese cyclophorid *Cyclotus* (*Pseudocyclophorus*) *discoideus* (see van Benthem Jutting, 1948: 576).

Cyclostoma articulatum Sowerby, Thes. Conch., 1, 1843, 142-143, pl. 28, figs. 160-161 (Demerara). This is the Jamaican *Adamsiella variabilis* C. B. Adams (see Vendryes, 1899: 14).

Cyclostoma thysanoraphe Sowerby, Thes. Conch., 1, 1843, p. 143, pl. 28, figs. 162-163 (Demerara and the Antilles). This is the Jamaican *Colobostylus thysanoraphe* (see Vendryes, 1899, p. 14).

Cyclostoma mirabile Sowerby, Thes. Conch., 1, 1843, 145-146, pl. 28, fig. 164 (Demerara, G. C. Bainbridge collector). This is the Jamaican *Adamsiella mirabilis* (see Vendryes, 1899: 14).

Cyclostoma chlorostoma Sowerby, Thes. Conch., 1, 1843, pp. 146-147, pl. 28, fig. 168 (Demerara, G. C. Bainbridge collector). To my knowledge, this has not yet been identified with any Jamaican species, yet since the other species collected by Bainbridge is Jamaican, in all probability this is another mislabeled Jamaican shell.

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Four other so-called pomatiasids have been described as coming from the American mainland. None have been seen since their original descriptions 80 to 115 years ago, and they probably represent erroneous locality records. It has not been possible to examine the type lots.

Cyclostoma bifasciatum Sowerby, Thes. Conch., 2, 1844, p. 167, pl. 31B, figs. 322-323 (Guayaquil, Ecuador); Pfeiffer, Conch. Cab., I, 19, (1), 1853, p. 264, pl. 36, figs. 3-4. This species was early recognized as being related to *Megalomastoma*, listed as a questionable species by Kobelt (1902: 269), and not mentioned by Bartsch and Morrison (1942) in their monograph of the American Cyclophoridae. It almost certainly is not a pomatiasid and probably not actually from Ecuador.

Cyclostoma thoreyanum Philippi, Zeits. f. Malak., 1851, p. 31 (Bolivia); Pfeiffer, Conch. Cab., I, 19, (1), 1853, p. 337, pl. 43, figs. 28-30. This species was not listed by Zischka (1953). The shell is quite similar to some of the Venezuelan and Colombian forms (*Tudora plicatula* group) and may be rediscovered. I have been unable to find any information about the collector Thorey, and consider the species to be of questionable validity.

Cyclostoma aspratile Morelet, Journ. de Conchyl., 21, 1873, pp. 125-126, pl. 5, fig. 2 (vicinity of Quito, Ecuador). This species was described together with *Cylindrella aequatoria* which had the same locality data and collector. Tomlin (1912: 323) stated that the latter species is the Cuban *Urocoptis* (*Arangia*) *sowerbyana* (Pfeiffer). It is

probable that restudy of the types of *Cyclostoma aspratile* will result in its being synonymized with some Cuban species. The Ecuadorean record is almost certainly erroneous.

Chondropoma subauriculatum Pfeiffer, Malak. Blatt., 9, 1862, pp. 153-154 (Cumana, Venezuela);

H. B. Baker (1923: 26) examined possible type lot material and suggested that this is a mis-labeled set of *Chondropoma biforme* Pfeiffer from Turk's Island, Bahamas.

DISTRIBUTION

After eliminating the spurious and unconfirmed records, there are pomatiasids known from Trinidad, the Dutch West Indies, Cumana and the entire coastal region of Venezuela, the Orinoco basin, but not Margarita Island (see Richards and Hummelinck, 1940), the Sierra Perija of Venezuela and Colombia, and the departments of Bolivar and Antioquia in Colombia. Material from Panama and Central America will be discussed elsewhere.

The few species known are not enough to consider the pomatiasids an important South American group. They seem to be a minor invasion from the West Indian islands. The habits of the species in clinging to leaves, or actually suspending themselves by slender mucous strands from leaves probably allow wind dispersal. Ecologically, they seem to be obligatory calciphiles, and almost any areas of limestone outcroppings would be capable of supporting a population.

Further collecting in northern South America may greatly increase the number of species, and anatomical studies may reveal that they represent a number of West Indian stocks. On presently available information, it seems best to retain a very conservative grouping into two generic units.

KEY TO THE SOUTH AMERICAN POMATIASIDAE

1. Lip of adult shell multiplex (Pl. 2, fig. 4) 2
   Lip of adult shell simple (or reflected) (Pl. 2, figs. 6, 7) 5
2. Spire of shell swollen, apex deeply decollated. 3
   Spire of shell not swollen, nuclear whorls either retained or only apical whorls decollated 4
3. Body whorl markedly solute, axial ribs strongly tufted at suture
   Choanopoma (*Choanopomops*) *barkeri perijensis* new subspecies

Body whorl adnate to penultimate, axial ribs only slightly tufted at suture
Choanopoma (*Choanopomops*) *barkeri barkeri* (Haas)

4. Axial sculpture of irregularly spaced, blade-like lamellae; Venezuela
Choanopoma (*Choanopomops*) *williamsoni* (H.B. Baker)
Axial ribs low, rounded, regularly spaced, co-equal in size; Trinidad
Choanopoma (*Choanopomops*) *aripensis* (Guppy)

5. Lip reflected 6
Lip simple, neither thickened nor expanded
Choanopoma (*Choanopomops*) *simplicistoma* new species

6. Umbilicus with 2 to 4 spiral cords 7
Umbilicus with 5 to 6 spiral cords, lip orange, apical whorls large; Antioquia, Colombia *Tudora* (*Tudorata*) *magnifica* new species

7. Umbilicus with 3 to 4 spiral cords, operculum heavily ribbed, last whorl barely solute; Bolivar, Colombia
Tudora (*Tudorata*) *woodringi* new species
Umbilicus with 2 to 3 spiral cords, operculum lightly ribbed, last whorl adnate to penultimate whorl; Venezuela
Tudora (*Tudorata*) *plicatula* (Pfeiffer)

SYSTEMATIC REVIEW

Attempts to identify the few specimens collected by Nino Sanfilippo necessitated study of the entire South American complex. Three new species and one new subspecies are recognized.

Genus **Choanopoma** Pfeiffer, 1847

(= *Annularia* of authors, not Schumacher, 1817)
Type species: *Turbo lincina* Linne, 1758.

Subgenus **Choanopomops** H. B. Baker, 1928

Type species: *Cyclostoma largillierti* Pfeiffer, 1846

The Central American *Choanopomops* are very similar in appearance to *C. barkeri* of Colombia, but the latter differs in having less flattened opercular lamellae and in lacking spiral sculpture. The other South American species have a shell much nearer the Central American group of *Chondropoma* (*Chondropomium*), but agree with *C. barkeri* in opercular and sculptural characters. The placing of the simple peristomed new species in this grouping is done on the basis of sculptural and opercular similarities.

Choanopoma (Choanopomops) aripensis (Guppy)
(Pl. 2, fig. 9)

Adamsiella aripensis Guppy, Ann. Mag. Nat. Hist., (3), 14, 1864, pp. 246-247 (Cerros of Aripo, northern Trinidad at 2,000 to 2,700 feet elevation); *Cistula aripensis* (Guppy), Crosse, Journ. de Conchyl., 38, 1890, pp. 56-57, pl. 2, fig. 6.

DISTRIBUTION: Known from patches of original forest in northern Trinidad.

REMARKS: The following opercular, peristomal, and sculptural characters serve to separate this species from its mainland relatives. Operculum with acentric nucleus, raised lamellar plates with overlapping separated edges which lie angular to the chondroid plate. Surface of moderately ribbed calcareous plates, outer edge of last opercular whorl reflected parallel to the condroid plate. Peristome multiplex, flaring, strongly sinuate. Sculpture of regularly spaced low rounded axial ribs with prominent spiral cording in the umbilicus.

Choanopoma (Choanopomops) williamsoni H. B. Baker
(Pl. 2, fig. 8)

Tudora williamsoni H.B. Baker, Occ. Pap. Univ. Michigan Mus. Zool., 137, 1923, pp. 26-27, pl. 2, fig. 8 (Quebrada Carampampa, west of Aroa, Estado Yaracuy, Venezuela).

Tudora williamsoni secana H.B. Baker, Occ. Pap. Univ. Michigan Mus. Zool., 137, 1923, p. 27 (Cerritos de Yumarito, Boqueron, Estado Yaracuy, Venezuela).

DISTRIBUTION: Known from near Aroa and Boqueron, Yaracuy, Venezuela.

REMARKS: The subspecies *secana* was differentiated on the basis of size and other characters reflecting the moister habitat at Boqueron. In view of the wide range of variation reported for *Tudora plicatula* (see below), it seems best to sink the subspecific name.

The distinguishing characters of *C. williamsoni* are as follows: Operculum with nearly central nucleus, lamellar plates raised, with edges overlapping but separated, plates angular to the chondroid plate, surface moderately ribbed, outer edge of last lamellar plate turning parallel to the chondroid plate. Peristome multiplex, flaring, only slightly sinuate. Sculpture of irregularly spaced lamellar ribs, with umbilical spiral cording obscured by the axial plates.

Choanopoma (Choanopomops) simplicistoma new species
(Pl. 2, fig. 7)

DIAGNOSIS: A species of the *Choanopoma aripensis* (Guppy) and *Choanopoma williamsoni* (H. B. Baker) group which is characterized by its simple, unreflected peristome, the lamellar plates of the nucleus parallel to the chondroid plate and fused to form a single heavily ribbed plate, an axial sculpture of both major and minor ribs, and possessing a spiral sculpture of micro-riblets.

HOLOTYPE: USNM 508803 from Cerro Chichiriviche, Silva, Falcon, Venezuela. H. G. Kugler collector, May 1934.

DESCRIPTION: Shell elongate-conic, not swollen, whorls 6-1/2 to 7-1/2, sometimes with apical whorls decollated, whorls of spire strongly rounded with deep sutures. Sculpture of moderately high, rounded growth ribs, occasionally clumped in twos, interspersed with one to three minor riblets. At sutural areas ribs sometimes prolonged into blade-like lamellae which often have been broken, revealing a hollow interior. Spiral sculpture of microscopic riblets whose width is about one-third the size of their interstices. Body whorl not solute until last 0.3 mm., or actually adnate to preceeding whorl. Peristome simple, neither thickened nor expanded. Umbilicus open, without prominent spiral sculpture, although some specimens show traces of the typical cording. Operculum with nearly central nucleus. Calcareous plates raised and reflected parallel to the chondroid plate with overlapping edges fused to form a continuous plate. Central two whorls of calcareous portion usually lost. Surface of operculum strongly ribbed. Height of holotype 11.7 mm., minor diameter 5.3 mm., whorls 7.

PARATYPES: Cerro Chichiriviche (USNM 508803, CNHM 84672), Genoa Museum, west of Cumarebo, Falcon (USNM 420507, CNHM 84761).

REMARKS: The appearance of this species immediately recalls *Tudora* (*Bonairea*) *maculata* H. B. Baker (1924b: 42-44, pl. 8, figs. 22-24) from Bonaire, Dutch West Indies. This species has the same simple peristome and opercular characters, but obviously differs in the sculpture and solute body whorl. Rather than considering the two species related, it seems probable that they represent parallel developments from the two stocks - *maculata* from *Tudora* and *simplicistoma* from *Choanopomops*.

Most of the available material was collected dead and with the simple peristome it is difficult to separate nearly adult from adult spe-

cimens. Obviously adult specimens ranged from 10.6 to 12.3 mm. in height with 6-1/2 to 7-1/2 whorls. Most specimens retained the nuclear whorls.

Choanopoma (Choanopomops) barkeri (Haas)

In this one species we have the following transitions in the « generic characters » used by HENDERSON and BARTSCH (1920): axial ribs from simple to tufted at the suture; body whorl adnate to solute; and spiral sculpture present or absent on the shell.

Choanopoma (Choanopomops) barkeri barkeri (Haas)

(Pl. 2, fig. 1)

Annularia barkeri Haas, Fieldiana, Zoology, 31, (46), 1951, pp. 505-506, fig. 97 (Sierra Cachiri, northwest of Maracaibo, Dist. Mara, Estado Zulia, Venezuela).

DISTRIBUTION: Known from the type locality and the Rio Caroni, 45 mi. northwest of Mt. Roraima, Est. Bolivar, Venezuela (T. Pain! 1938, Pain's Collection).

REMARKS: The typical subspecies may prove to be widely distributed on the Venezuelan side of the Sierra Perija. Lots of shells intermediate between *barkeri* and the new subspecies, *perijensis*, were seen from the Quebrada Paradero, 18 km. southwest of Carraipia, Guajira, Colombia (USNM 599654, CNHM 84683), Valledupar, Magdalena, Colombia (T. Pain! 1939), and La Paz, Magdalena, Colombia (USNM 543469). These shells had the peristome appressed to the penultimate whorl as in typical *barkeri*, but had the tufted sutural lamellae of *perijensis*, and a slight indication of the solution of the last whorl characteristic of the new subspecies.

The material from the Rio Caroni on the Guiana Shield could not be separated from the holotype (CNHM 30904) and paratypes (CNHM 30905) of the nominate subspecies. The occurence of the same species in two such widely separated areas as the Sierra Perija and the Guiana Shield is quite remarkable, especially considering the restricted range of most pomatiasids. Mr. Pain states that possibly there might be an error in labeling, but the record is tentatively accepted.

Choanopoma (Choanopomops) barkeri perijensis

new subspecies

(Pl. 2, fig. 2)

DIAGNOSIS: A subspecies of *Choanopoma barkeri* separated from the nominate race by its solute last whorl which results in the entire peristome being free of the penultimate whorl, and in having the axial ribs consistently produced into tufted lamellae below the suture of each whorl.

HOLOTYPE: USNM 534076 from Cerro Chimichagua, 20 miles east of El Banco, Magdalena, Colombia. Oscar L. Haught collector.

DESCRIPTION: Shell elongate-conic with spire sometimes moderately swollen, whorls remaining after decollation 3½-5½ or 6½-7½ in complete individuals. Whorls of spire only slightly rounded with relatively shallow sutures. Sculpture of low, closely set, slightly retractive radial ribs, which become prolonged into lamellar plates at the top of each whorl just below the suture. Body whorl solute for 2-3 mm., with the expanded peristome lying completely free of or occasionally barely touching the penultimate whorl. Umbilicus open showing up to ten spiral cords which are cut by the blade-like axial ribs. In a few examples the spiral sculpture is carried onto the spire as a series of low broad swellings perpendicular to the axis of the shell. Operculum with raised calcareous lamellae slightly narrower than the underlying chondroid plate. Edges of lamellae inclined to the plate, not parallel to it. Nucleus of operculum only slightly eccentric. Height of holotype 17.2 mm., minor diameter 7.2 mm., whorls remaining 5.

PARATYPES: Cerro Chimichagua (USNM 473939, USNM 534076, CNHM 84682, Genoa Museum), Rio Cesar Valley (USNM 534071), western foothills of Sierra Perija at 200 to 500 meters altitude (USNM 473929, CNHM 84678), along Quebrada Boquete, 5 km. North of Becerril, Magdalena (USNM 599482, CNHM 84681), and near Codazzi, at 100 to 300 meters altitude, Magdalena (USNM 599517, CNHM 84680).

REMARKS: This is, so far as known, a foothills species of the Sierra Perija flank of the Rio Cesar Valley is Magdalena, Colombia. At the type locality, Cerro Chimichagua, and successively further north at Becerril and Codazzi only typical *perijensis* is found. Near the northern part of the basin, one specimen from La Paz (USNM 543469) and a series from 18 km. southwest of Carraipia, Guajira (USNM 599653, CNHM

84683) are intermediate between typical *barkeri* of the Sierra Cachiri in Venezuela and the Rio Cesar subspecies *perijensis*.

Genus **Tudora** Gray, 1850

Type species: *Cyclostoma simile* Sowerby, 1843 (= *Cyclostoma megacheilos* Potiez and Michaud, 1838).

Subgenus **Tudorata**, H. B. Baker, 1924

Type species: *Tudora muskusi* H. B. Baker, 1924

H. B. Baker (1924b) and Hummelinck (1940) studied the forms from the Dutch West Indies. The amount and extent of variation discovered in these areas is paralleled by the size range seen in the Venezuelan *Tudora plicatula*. The specimens collected by Nino Sanfilippo were the smallest examples seen, and at first glance unquestionably distinct from the larger forms of wet areas (see Pl. 2, figs. 3, 6). The entire Venezuelan series are considered to belong to one species, with different species found in Bolivar and Antioquia, Colombia. Another species, to be described elsewhere, occurs in Panama.

Tudora (Tudorata) plicatula (Pfeiffer)

(Pl. 2, figs. 3, 6)

Cyclostoma plicatulum Pfeiffer, Zeits. f. Malak., 1846, p. 48 (Locality unknown); Pfeiffer, Syst. Conch. Cab., I, 19, 1, 1848, pp. 82-83 pl. 10, figs. 14-15, pl. 28, figs. 12-13 (Porto Cabello, Venezuela); *Chondropoma plicatulum* Pfeiffer, Conch. Icon., *Chondropoma*, 1863, pl. 3, fig. 20; von Martens, Binnenmoll. Venezuela, 1873, p. 160, pl. 1, fig. 3.

Cyclostoma tamsiana Pfeiffer, Zeits. f. Malak., 1850, p. 77 (Porto Cabello, Venezuela); Pfeiffer, Syst. Conch. Cab., I, 19, 1, 1854, p. 276, pl. 37, figs. 19-20; *Chondropoma tamsiana* Pfeiffer, Conch. Icon., *Chondropoma*, 1863, pl. 10, fig. 75.

Cyclostoma cumanense Pfeiffer, Proc. Zool. Soc. London, 1851, p. 248 (Cumana, Venezuela); Pfeiffer, Syst. Conch. Cab., I, 19, 1, 1854, p. 315, pl. 41, figs. 18-19; *Chondropoma cumanense* Pfeiffer, Conch. Icon., *Chondropoma*, 1863, pl. 5, figs. 36a, 36b.

Cyclostoma venezuelense Pfeiffer, Monog. Pneumon. viv., suppl., 1853, p. 136, (Venezuela); *Chondropoma venezuelense* Pfeiffer, Conch. Icon., *Chondropoma*, 1863, pl. 6, fig. 45.

Tudora plicatula (Pfeiffer), H.B. Baker, Occ. Pap. Univ. Mich. Mus. Zool., 137, 1923, pp. 23-26, pl. 2, fig. 9.

Distribution: Estado Falcon: Dist. Silva, Cerro Chichiriviche (USNM) 508801, CNHM 84666); Dist. Zamora, Cumarebo (USNM 508836, CNHM 84668), west of Cumarebo (USNM 420508); Dist. Acosta, Rio Guararipano in the Araurima Valley (MCZ 125500, CNHM 84754), Guai-

bacoa (Genoa, CNHM 84753), Marsillal de la Costa (USNM 508841, CNHM 84669), Coro (USNM 349065, USNM 349066, USNM 426248, CNHM 84674, CNHM 84675), Riecito (USNM 508791, CNHM 84667), El Mene (USNM 508775, USNM 508821, CNHM 84676).

Estado Yaracuy: Boqueron (UMMZ 47924, UMMZ 79465), Palma Sola (UMMZ 47922, UMMZ 47923, UMMZ 79464, UMMZ 79466, CNHM 78847).

Estado Districto Federal: Puerto La Cruz (USNM 362138, USNM 362139, CNHM 84677), La Guiara (UMMZ 79488, USNM 428066).

Estado Sucre: Cumana (type locality of *cumanense*).

Estado Zulia: Encontrados (CNHM 11735).

Estado Carabobo: 6 miles west of Puerto Cabello (USNM 252851, CNHM 84673).

REMARKS: H. B. Baker (1923: 24-25) has given an excellent summary of the variation found in this species. The size of the specimens varies greatly depending on local conditions. Specimens from Encontrados (CNHM 11735) were the largest examples seen, ranging from 18-20.5 mm. in length for the larger « female » shells and 13.5-16.0 for the smaller « male » examples. In contrast the many sets of shells from the dry areas of Dist. Acosta in Falcon did not exceed 14.3 mm. in length, and those from Guaibacoa (Genoa Museum) ranged from 11.7-13.1 mm. in length. Shells from the wetter areas of Yaracuy were intermediate in size. No constant differences in sculpture, operculum, aperture, or color pattern could be found between the various sets of shells. Since land operculates often vary greatly in size (for example *Megalomastoma croceum* from Porto Rico, see H. B. BAKER, 1943), the differences are considered to be of no value in separating species or subspecies and I'm recognizing only one species from this area.

Specimens from Puerto La Cruz (USNM 362138, CNHM 84677) and La Guiara (UMMZ 79488) were very small and quite strongly decollated in comparison with specimens from nearby localities. The color pattern of dots was significantly heavier and collections are needed to determine if this might be a valid ecological race of the sea shore, or even a distinct species.

Tudora (Tudorata) woodringi, new species
(Pl. 2, fig. 5)

DIAGNOSIS: A species differing from the Venezuelan *Tudora plicatula* in having the lip proportionately more expanded, the whorls

slightly more prominently rounded with the sutures more impressed, the umbilicus wider and with more prominent spiral sculpture, and the operculum with more prominent ribbing on the calcareous plate.

HOLOTYPE: USNM 360749 from Pijiguay, Dept. Bolivar, Colombia. Wendell P. Woodring collector, March 24, 1923.

DESCRIPTION: Shell elongate-conic, not swollen, whorls 6 1/8 - 7, strongly rounded with deeply inset sutures. Apical whorls 1 3/4, smooth, unicolored or basal portion orange to purple, usually retained, plug only poorly developed in examples of decollation. Remaining whorls with moderately widely spaced, slightly retractive, prominent axial ribs. Sutural edges of ribs often prolonged into crested lamellae. Ribs placed singly, never grouped. Last whorl slightly solute at edge, resulting in a more open umbilicus than is found in *T. plicatula*. Umbilical sculpture of three or four spiral lamellae partially obscured by the axial ribbing. Color light horn, a few specimens with 4 rows of brown dashes. Aperture with broadly reflected simple lip. Operculum with heavy calcareous plates, deeply channeled at edge, with moderately strong ribbing on the plate surface. Position of nucleus and form of plate as in *T. plicatula*. Height of holotype 13.0 mm., minor diameter 7.0 mm., whorls remaining 5 1/8.

PARATYPES: USNM 360749, CNHM 84670, Genoa Museum.

REMARKS: The differences between *T. plicatula* and *T. woodringi* are all of degree rather than absolute. Despite the wide variation found in *T. plicatula*, none of the Venezuelan specimens actually duplicated or came close to duplicating the characters which are used to separate *T. woodringi*. Collections made in the wide geographic gap separating the two ranges may provide intermediate examples and reduce *woodringi* to subspecific status.

The largest undecollated specimen seen was 15.1 mm. high, minor diameter 7.4 mm. with 6 1/2 whorls (female?); the smallest undecollated specimen was 11.9 mm. high, minor diameter 6.3 mm. with 6 whorls (male?).

The species is named after its collector, Wendell P. Woodring.

Tudora (Tudorata) magnifica, new species
(Pl. 2, fig. 4)

DIAGNOSIS: A species of *Tudorata* characterized by its large size, very broadly expanded orange lip, prominent and numerous umbilical sculpture, and very large apical whorls.

HOLOTYPE: USNM 488857 from Nicochi, on the Gulf of Uraba, north of Turbo, Dept. Antioquia, Colombia. Oscar L. Haught collector.

DESCRIPTION: Shell large, elongate conic, whorls 6 3/4, moderately strongly rounded with impressed sutures. Apical whorls 1 3/4, smooth, color as in *T. woodringi*, usually decollated with a strong purple plug. Sculpture of very low, rounded, closely set, almost vertical growth ribs. Occasionally a few ribs extend into lamellar plates at the sutures. Last whorl barely solute at the aperture with a widely flaring, orange colored, reflected lip. Umbilicus widely open with 5-6 spiral ribs only partially obscured by the axial sculpture which becomes hair-like in the umbilical region. Operculum as in *T. woodringi*. Height of holotype 16.7 mm., minor diameter 7.7 mm., whorls remaining 5.

PARATYPES: USNM 488857, CNHM 84679, Genoa Museum.

REMARKS: The size of the nuclear whorls, flaring, orange colored lip, and umbilical sculpture easily separate this species from the other mainland pomatiasids. The designated holotype is the smallest specimen seen, but was chosen since the color and sculpture were better preserved in this example than in other specimens available. The largest example was 20.9 mm. high, minor diameter 9.4 mm. with 5 3/8 whorls remaining.

Only one of the fourteen specimens had the nuclear whorls remaining. In the other examples, the apical whorls were lost and the opening closed with a purple colored plug.

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RIASSUNTO

Sono enumerate 4 specie di Molluschi non marini, raccolti nel Venezuela da N. Sanfilippo. Uno di essi appartiene a una nuova sottospecie (*Eudolichotus glabra paraguanensis*). Sono trattate le specie di *Eudolichotus* viventi nel Venezuela. Viene compiuta una revisione dei *Pomatiasidae* del Sud-America, presentando una chiave delle 8 forme note, tre delle quali sono descritte come nuove.

EXPLANATION OF PLATE XV

Plate 2 (XV)

1. *Choanopoma* (*Choanopomops*) *barkeri barkeri* (Haas). Cerro Cachiri, northwest of Maracaibo, Dist. Mara, Est. Zulia, Venezuela. Holotype. Collected by R. Wright Barker. CNHM 30904.

2. *Choanopoma* (*Choanopomops*) *barkeri perijensis* new subspecies. Cerro Chimichagua, 20 mi. east of El Banco, Magdalena, Colombia. Holotype. Collected by Oscar L. Haught. USNM 534076.

3. *Tudora* (*Tudorata*) *plicatula* (Pfeiffer). Encontrados, Zulia, Venezuela. Collected by N. Dearborn. CNHM 11735. A giant specimen with very low crowded sculpture.

4. *Tudora* (*Tudorata*) *magnifica* new species. Nicochi, north of Turbo, Antioquia, Colombia. Holotype. Collected by Oscar L. Haught. USNM 488857.

5. *Tudora* (*Tudorata*) *woodringi* new species. Pijaguay, Bolivar, Colombia. Holotype. Collected by W.P. Woodring. USNM 360749.

6. *Tudora* (*Tudorata*) *plicatula* (Pfeiffer). Guaibacoa, Falcon, Venezuela. Collected by Nino Sanfilippo. Genoa Museum. An exceptionally small specimen with widely spaced sculpture.

7. *Choanopoma* (*Choanopomops*) *simplicistoma* new species. Cerro Chichiriviche, Silva, Falcon, Venezuela. Holotype. Collected by H.G. Kugler. USNM 508803.

8. *Choanopoma* (*Choanopomops*) *williamsoni* (H. B. Baker). Quebrada Carampampa, west of Aroa, Silva, Falcon, Venezuela. Paratopotype. Collected by H. B. Baker. CNHM 84684.

9. *Choanopoma* (*Choanopomops*) *aripensis* (Guppy). Oropouche, Trinidad. CNHM 84690.